



1 (a) TITLE OF THE INVENTION

2 THREE COMPONENT PROTECTIVE HEAD GEAR

3 POWERED BY A RECHARGEABLE BATTERY

4 (b) CROSS-REFERENCE TO RELATED APPLICATIONS

5 NOT APPLICABLE

6 (c) STATEMENT REGARDING FEDERALLY SPONSORED

7 RESEARCH OR DEVELOPMENT

8 NOT APPLICABLE

9 (d) INCORPORATION-BY-REFERENCE OF MATERIAL

10 SUBMITTED ON A COMPACT DISC

11 NOT APPLICABLE

12 (e) BACKGROUND OF THE INVENTION

13 (1) FIELD OF THE INVENTION

14 This application relates to a new and improved headgear,  
15 and more specifically to a headgear or helmet providing a  
16 lighting display for use by cyclists, construction and  
17 underground workers, search and rescue persons, emergency medical  
18 workers, firemen, police, meter readers, and so forth. The  
19 lighting display may be used to define a forward pathway or to  
20 illuminate objects, or to rearwardly signal a wearer's presence.

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1 (2) DESCRIPTION OF RELATED ART INCLUDING INFORMATION

2 DISCLOSED UNDER 37 C.F.R. 1.97 AND 1.98

3 Various types of protective helmets providing lighting  
4 displays are known in the prior art, and typical types of these  
5 helmets are described in U.S. Patents 5,040,099; 5,327,587;  
6 5,329,637; 5,357,409; 5,426,792; 5,479,325; 5,544,027; 5,485,358;  
7 5,564,128; 5,570,946; 5,743,621; 5,758,947; 5,871,271; 6,007,213;  
8 6,009,563; 6,113,244; 6,244,721; 6,328,454; 6,340,234; 6,464,369;  
9 and, 6,497,493.

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11 However, none of the headgear in these patents disclose  
12 a battery powered circuit for an LED array that produces a long  
13 term, uniform illumination while providing a useful device for  
14 its intended purpose. The headgear structure of this invention  
15 may be a single, or a multi-component type, such as two or three.

16 (f) BRIEF SUMMARY OF THE INVENTION

17 A new and improved headgear is provided with a lighting  
18 display comprising an LED array powered by built-in, rechargeable  
19 batteries through a unique circuit which enables a long-term,  
20 suitably constant output.

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1 (g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

2 FIG. 1 is an upper perspective view of the assembled  
3 headgear of this invention;

4 FIG. 2 is an exploded view of the upper and lower  
5 headgear components of the invention and the LED array;

6 FIG. 3 is a sectional side elevation view of the headgear  
7 taken along lines 3 - 3 of FIG. 1;

8 FIG. 4 is a circuit diagram of this invention for feeding  
9 power from the rechargeable batteries to the LED array; and,

10 FIG. 5 shows the LED array connected to the rechargeable  
11 batteries.

12 (h) DETAILED DESCRIPTION OF THE INVENTION

13 The headgear 10 of this invention is shown in FIGS.  
14 1 - 3, and comprises an upper helmet portion 11 defining an  
15 integrally formed, outer central reinforcing ridge 12 and a  
16 corresponding interior reinforcing grid area 13. Into the grid  
17 area 13 are mounted removable or rechargeable lithium ion battery  
18 packs 14 and 15 which connect to a circuit board 16, the circuit  
19 itself being shown in FIG. 4. Wire connections from the  
20 batteries to the circuit board and to the LED arrays are shown in  
21 FIG. 5.

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1           A rearwardly installed LED array 17 is mounted on the upper  
2 helmet portion 11 and are connected to the circuit board and  
3 driven by the battery packs. The LED array 17 is shielded by a  
4 transparent acrylic sheet 18 mounted on the exterior of the upper  
5 helmet 11. The front area of the upper helmet 11 is provided  
6 with an enclosure 20 shielded by a curved, transparent acrylic  
7 sheet 21 which protects an enclosed, front facing LED array 22.

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9           An interfitting helmet portion 25 is configured to  
10 interlock with the upper helmet portion 11, the two helmet  
11 portions being secured together vertically by screws 26. The  
12 helmet portion 25 defines a flat portion 27 which registers with  
13 grid area 13 and contacts the lower sides of the battery packs  
14 14, 15 thereby securing the battery packs in place. As  
15 indicated, the front area of the helmet 25 defines the enclosure  
16 20 into which the front facing LED array 22 is mounted.

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18           The LED array 22 is driven through the circuit board 16  
19 from the battery packs 14 and 15 as shown in FIG. 4, similarly to  
20 the LED array 17 and the circuit of FIG. 4, which will be  
21 described, infra. FIGS. 3 - 5 show an on-off switch 28 connected  
22 to the circuit board 16 and circuit of this invention. FIG. 3  
23 also shows a charging outlet pin 29 for the battery packs 14 and  
24 15, the charging pin being adjacent to the on-off switch 28. The  
25 batteries also may be removed for recharging or replacement.

1       An integrally formed, reinforcing wrap-around section 11a  
2   on the helmet portion 11 defines bores 30 coinciding with bores  
3   (not shown) in the helmet portion 25 through which pass screws 31  
4   which horizontally secure the helmet portions 11 and 25 together.  
5   The screws 26 and 31 thereby secure the helmet portions 11 and 25  
6   both vertically and horizontally. If desired, an edge liner 25a  
7   of injection molded polypropylene may be employed to engage the  
8   edges between the helmet portions 11 and 25, and thereby effect  
9   additional securement between the two helmets.

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11       As shown in FIG. 3, a protective foam head enclosure 32 such  
12   as constructed from polyurethane or polystyrene foam is provided  
13   to cushion the wearer's head from impact against the much harder  
14   ABS plastic materials of both the helmet portions 11 and 25.  
15   Similar bores (not shown) in the head enclosure 32 register with  
16   the bores 30 and enable the helmet portions 11 and 25 and the  
17   head enclosure to be secured together using the screws 31.

18       The circuit shown in FIGS. 4 and 5 enables a relatively long  
19   and uniform battery power output before charging is required.  
20   The lithium ion batteries JP1 and JP3 shown in FIGS. 4 and 5 each  
21   deliver about 6600 milliamps at 7.2 volts and are isolated from  
22   each other by a diode D3. When the on-off switch 28 (FIG. 3) is  
23   turned on at JP1, the batteries JP1 and JP3 will turn on a  
24   comparator such as an op amp comparator JP2, e.g. an LM358.

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1       The comparator JP2 shows a direct coupled amplifier  
2 configuration driven from the battery JP1 through transistors  
3 PNP Q1 and NPN Q2, and through the coupling resistance R7 to the  
4 input pin 1 of JP2. Resistances R1, R2, R3, R6/R4 respectively  
5 will protect a Zener D1, Q1, R5-JP2 and LED arrays D2 (17, 22)  
6 from excessive current/voltage.

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8       Battery power from JP3 is applied to the voltage divider R5  
9 and then to pin 2 of JP2, while pins 3, 4 of JP2 are both at  
10 ground. Obviously, the op amp comparator JP2 is driven by both  
11 batteries JP1 and JP3. Capacitor C1 and resistance R8 are both  
12 grounded, and provide ripple filtering, and R8 also shunts  
13 voltage from pin 3 of the JP2 to the Zener D1. JP2 (at pin 8)  
14 also drives the Zener which functions as a shunt to maintain the  
15 load voltage constant for changing current/voltage variations due  
16 to running down of the batteries. In the reverse conduction  
17 condition as shown, the Zener D1 also reduces ripple voltage.

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19       When the switch 28 (FIG. 3) is turned on at JP1, and voltage  
20 from the voltage divider R5 exceeds the pin 3 reference voltage,  
21 the comparator JP2 (LM358) will turn on, and hence transistors Q1  
22 and Q2 (driven from JP1 and JP3) will then turn on the LED arrays  
23 D2 (17, 22).

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1       Typically, the lumen output of the present device for about  
2   93 LEDs is about 4000 MCD @ 20 milliamps for 5 - 5 1/2   hours  
3   using 7.2 volt batteries. Moreover, the device of this invention  
4   frees up the wearer's hands when viewing an operating field,  
5   especially in an emergency situation.

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7       It will be appreciated that while a Zener diode is preferred  
8   for use in the circuit described, other semiconductor devices  
9   with similar turn-on characteristics may be utilized, and they  
10   are described in the "SCR MANUAL, INCLUDING TRIACS AND OTHER  
11   THYRISTORS" Sixth Edition, 1979 by General Electric, and  
12   incorporated herein, by reference.

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14       Additionally, the circuit of this invention may be employed  
15   for illuminating purposes other than in a helmet, such as an LED  
16   array in a flashlight; to function as a traffic signal; as an LED  
17   turn on device used with an alarm detection system; and so forth.